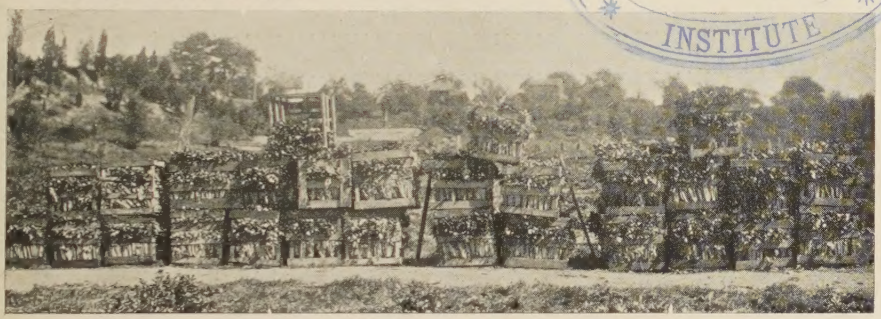
DISEASES OF CELERY

New Jersey

Agricultura Experiment Stations

Circular 112

IMPERIAL MYCOLOGICAL
23 SEPT. 1935
INSTITUTE



EFFECT OF SPRAYING

Celery crated for market, from experiments on Spell farm, Oradell. The 4½ crates at the extreme left, and the 5 crates (between the two boards) were taken from separate unsprayed plots. The remaining two lots, the one on the extreme right of 9 crates, and the other, the second inward from the left, were taken from separate plots, both of which were sprayed with a Bordeaux mixture (5-6-50). All plots were of the same size and adjacent to each other. Notice the length of the sprayed and unsprayed plants.

By W. S. Krout, M. A.

NEW BRUNSWICK, N. J.

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NEW JERSEY
AGRICULTURAL EXPERIMENT STATIONS
CIRCULAR 112

COMMON DISEASES OF CELERY [1]

The purpose of this circular is to give to the celery growers of New Jersey descriptions of the most common and important diseases of celery, and the latest methods for their control. The writer spent two years in the study of the celery diseases in the vicinity of Oradell, New Jersey, and this publication is the outgrowth of this work.

Bacterial Rots

These diseases are exceptionally severe in some localities of this state. This is especially true in the Oradell-Ridgewood celery district where cultural methods are exceptionally intense, three crops generally being grown during the year.

Crown Rot has been known in the Oradell-Ridgewood district for about twelve years, and what appears to be the same disease occurs in other parts of the country. It is both a seed-bed and a field disease. It is caused by a germ which attacks the roots of the seedling and works upward, causing them to die very quickly. Seedlings which are only slightly infected are often transplanted to the field where most of them soon die. Those that live are much dwarfed and are of poor quality (fig. 1). In the field, the disease attacks the roots and works upward through the fibrous woody parts of the short stem. When the roots or stems are cut across, the fibrous or woody strands show a rusty color. Sometimes only one side of the root system of the plants is infected; this is especially true of the older plants. The disease of the root system is accompanied by a yellowing of the tops and this is followed by rotting. This disease is very severe, frequently destroying the greater part of the crop. It is most destructive on Golden Self-blanching celery.

Control. The control of this disease should begin with soil sterilization of the seed-bed (fig. 2, also page 11). Where it is impossible to sterilize the soil the New Easy Bleacher, or other

[1] Prepared by Webster S. Krout, M.A., formerly assistant in the Department of Plant Pathology of the New Jersey Agricultural Experiment Station. Published July 10, 1919.

resistant varieties, should be grown instead of the Golden Self-blanching.

FIG. 1. A CELERY PLANT AFFECTED WITH THE CROWN ROT DISEASE. Notice its dwarfed appearance.

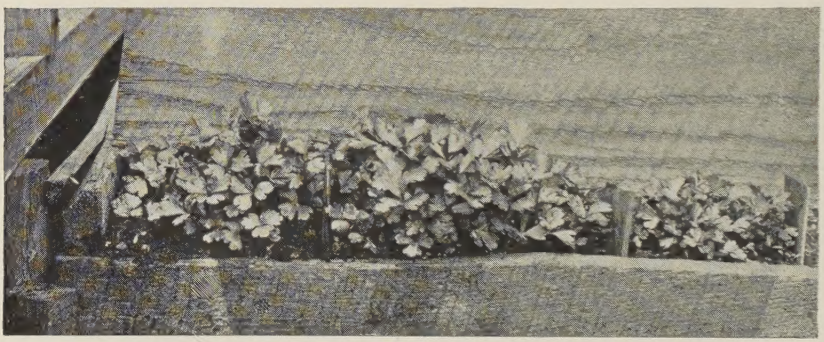

FIG. 2. THREE LOTS OF PLANTS GROWN ON INFESTED GREENHOUSE SOIL AFTER THE FORMALDEHYDE TREATMENT. Beginning at the left the seed was sown respectively 4, 7 and 11 days after the application. The 7-day plot gave the most and best plants.

HEART ROT is well described by its name. The innermost, tender parts of the plant are destroyed by a bacterial rot. In the early

stages of the disease, the tips of the leaves wilt and appear water-soaked. Later the entire leaf and most of the petiole rots down into a black mass (fig. 3). As many as 16 leaves and petioles have

FIG. 3. A GOLDEN SELF-BLANCHING CELERY PLANT INFECTED WITH THE HEART ROT ORGANISM. Notice how the small inner leaves and petioles have rotted down into a black mass.

been observed to be infected on a single plant. Generally, it starts at the tips of the leaves and works downward, and into the heart of the plant. However, cases have been observed where infection has apparently taken place directly on the petioles. This disease is frequently very destructive, sometimes destroying 90 per cent of the crop. It also is most severe on the Golden Self-blanching variety.

Control. Burn all the rubbish, especially the diseased plants of the old crop, and use such resistant varieties as the New Easy Bleacher or the Giant Pascal.

SOFT ROT (*Bacillus corotovorus* Jones) is similar in some respects to heart rot, but is mainly a disease of stored celery.

Blights

EARLY BLIGHT (*Cercospora apii* Fr.).—This is a very widely distributed fungous disease, occurring in both Europe and America.

FIG. 4. A CELERY LEAFLET SHOWING EARLY BLIGHT SPOTS. The light-colored blotches were caused by the fungus. Notice their number, size and shape. Observe that the spots differ from those of the late blight in size and absence of pycnidia.

In this state it appears in the early part of June, but seldom does much damage until the warm, wet weather of July and August. It appears either on the upper or lower surface of the leaves as small, yellow-green spots which soon take on a watery cast. The spots sink and enlarge rapidly. In 3 to 5 days after their first appearance, the spots have a light brown central area surrounded by a band of yellow. The light brown area gradually turns to a dark brown.

During moist warm weather an examination of the spots in the morning will show a grayish-white growth of the fungus which withers during the day. These conditions are most favorable for the spreading of the fungus which causes the disease. The spots vary in shape, being "half-moon," sub-circular or triangular (fig. 4 and fig. 6, right-hand side.) They may appear on the tip, margin

FIG. 5. A CELERY LEAFLET SHOWING LATE BLIGHT SPOTS. Observe the following: (a) the smallness, number, and coalescing of the spots; (b) the small black pycnidia in the spots which produce the spores; (c) the crinkling of the leaflet due to the action of the organism.

or base of the leaf. The disease also attacks the petioles of the leaves, producing long, narrow, water-soaked spots at various points.

Control. Burn or bury the celery trash of preceding crops, and spray thoroughly with Bordeaux mixture (page 7).

LATE BLIGHT (*Septoria petroselini* Desm. var. *apii* Br. and Cav.). This is a fungous disease which is very widely distributed and very destructive. In this state the disease is first noticed about July 15, but it seldom does much damage until the cool, wet days of September and October when it may become extremely severe. The

disease starts on either surface of the leaf as small, sub-circular spots, orange to lemon-yellow in color. They are slightly sunken and usually surrounded by yellow bands. In one or two days these spots appear water-soaked, much sunken, more irregular in out-

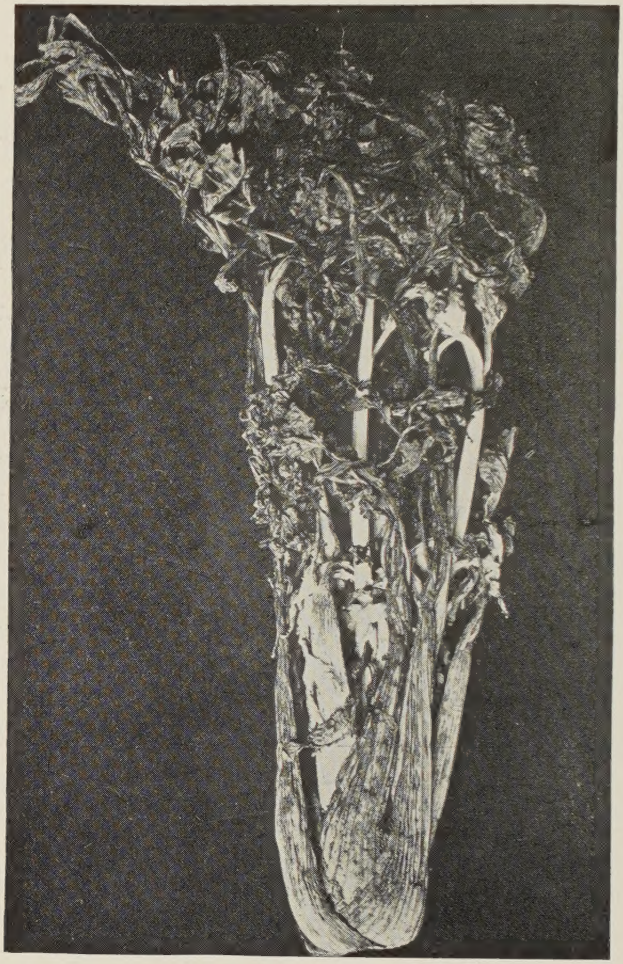

FIG. 6. A MATURE CELERY PLANT AFFECTED WITH LATE BLIGHT. Notice the crinkling, rotting, and drying of the outside petioles and leaves.

line, and a few dark brown pinhead-like fruiting bodies are scattered over the central part. These spots gradually become brown or black, and therefore some growers speak of this disease as the "black blight" (fig. 5). The spots tend to unite, forming larger spots or blotches with irregular borders. More or less elongated spots also

occur on the petioles of the leaves (fig. 7). When severe, this disease is followed by a rot which often causes heavy losses in both field and storage.

Control. Burn the celery refuse and spray thoroughly with Bordeaux mixture.

The spores of the fungus causing the late blight are carried on the seed, but experimental work carried on by the author shows that they are dead on seed two or three years old. Also it is well known that the seed will germinate well at these ages. Therefore, the use of seed two or three years old will eliminate the danger of infection from this source.

The author has also demonstrated that heating in a double boiler at 113 to 118° F. for thirty minutes will kill the fungus, but will not injure the germination of the seed.

Comparison of Early and Late Blights

EARLY BLIGHT	LATE BLIGHT
Spots on both surfaces of the leaf.	Spots on both surfaces of the leaf.
Starts early in June. Most destructive in July and August.	Starts about the middle of July. Most destructive in September and October.
Spots, large, "half-moon," sub-circular, or triangular, uniting into irregular blotches.	Spots small, sub-circular, sunken, uniting into irregular blotches
Spots light brown with yellow band, becoming dark brown and developing a grayish-white fungous growth over the surface during heavy dews or rains.	Spots orange or lemon-yellow, becoming water-soaked and developing dark pin-head fruiting bodies over the central part.
Usually starts on tip or margin of leaf.	Usually starts within the leaf.
Attacks petiole.	Attacks petiole.

Other Troubles

DAMPING-OFF (*Sclerotinia libertiana* Fcl.). This is a fungous disease of the seed-bed which occasionally occurs in the field. It attacks the plants at the surface of the ground, causing them to wilt, fall and decay. The fungus appears as a mold or cotton-like growth over the decaying plants which is followed by the formation of small hard black bodies known as sclerotia. These sclerotia eventually

produce small cup or mushroom-like bodies. The disease is sometimes very destructive and also attacks lettuce, tomatoes, beans, cucumbers, and other plants.

Control. The disease can be held in check by (a) the removal and destruction of the infected seedlings together with the surrounding soil; (b) careful ventilation; (c) avoiding excess of water; and (d) avoiding too sudden changes in temperature. Sometimes the disease can be reduced or eliminated by the application of a layer of hot sand to the infected area.

TRUE RUSTS (*Puccinia bullata* (Pers.) Wint., and *P. castagnei* Thum.) are of no importance in this state.

FALSE RUST may be due to any one of several causes, but is of very little importance in this state.

ROOT BINDING. This trouble appears when the foilage is about one-third grown. The foilage turns yellow, the roots become very numerous and have the appearance of being pot-bound. This trouble is most severe on poorly drained, gravelly clay soil.

Control. Good drainage, the addition of humus and the proper setting of the seedlings will do much toward the elimination of this trouble.

RUSTY ROOT is a field trouble of young plants grown in primitive muck soil. The roots of the plant yellow, fail to grow, crinkle, and branch abnormally. The foilage turns yellow and the plant soon dies. Continued use of the land with the addition of large quantities of horse manure tends to correct this trouble in a few years.

NEMATODES are very small eel-like worms (*Heterodera radicicola*) which cause bead-like galls on the roots and a dwarfing of the plants. They are sometimes severe in the seed-beds, but seldom of importance in the fields in this state. They can be held in check by soil sterilization (page 11).

Methods of Control

SANITATION.—It is very evident that the organisms causing the rots and damping off are carried over in the soil, both in the seed-bed and in the field. It also appears that these organisms live over to much better advantage in the greenhouse than out-of-doors. It is also very evident that the early and late blights are carried over on dead plants in the field. Therefore, it would appear that the sterilization of the soil in the seed-beds and the raking and burning of the old plants in the field will tend to reduce the amount of initial infection.

CELERY CULTURE is closely connected with blight control. Use only the strongest and most vigorous plants. Keep the plants free

of weeds and well cultivated, as this gives a strong vigorous plant capable, to a certain extent, of resisting disease. Cultivation should not be practiced while the foilage is wet, as this spreads the fungous spores from plant to plant.

SEED-BED AND SOIL STERILIZATION.—Seed-beds, whether out-of-doors or under glass, should be prepared with the greatest possible care in order to prevent the infection of the young plants before setting. This will reduce the losses both in the seed-beds and in the field. In the greenhouse, brush down all parts with a broom, and spray thoroughly with a 5-5-50 Bordeaux mixture or with formaldehyde (3 to 4 pints in 50 gallons of water.) All manures and fertilizers are added before the treatment. The soil should be loose and well pulverized; and damp but not waterlogged. Use a formaldehyde solution of 3½ pints in 50 gallons of water and apply at the rate of 1 gallon to the square foot of soil surface. This is applied in two parts, ½ gallon each time. In the case of loose muck soil, the soil should be turned and stirred after the first application. In the case of heavy soil, stirring should be avoided. Cover with burlap, old carpet, canvass, fertilizer bags, or paper, for 48 hours or longer. Remove covering, stir and air thoroughly to allow the formaldehyde to escape. Celery seed may be sown as soon as the soil is dry enough. Our best results were obtained by sowing seed 7 days after the application (fig. 2).

SPRAYING.—The early and late blight diseases of the celery can be controlled by spraying with Bordeaux mixture.[2] Since this is a preventive measure and not a cure it is necessary that the spray should be applied before the infection of the plants. In this state the blights seldom appear on the seedling plants, but the author's experience indicates that spraying in the seed-bed with a 3-4-50 Bordeaux mixture is advantageous. After transplanting to the field, the plants should be sprayed with a 5-6-50 Bordeaux mixture every 7 to 14 days, dependent on the weather; if the weather is wet they should be sprayed more often than if dry. The amount of mixture used at each application will depend on the size of the plants; large plants will require 200 to 250 gallons per acre for each application. Both surfaces of the leaves should be thoroughly covered.

The kind of apparatus will depend on the acreage. However, the mixture should be applied with sufficient force (100 pounds or more per square inch) to produce a fine spray if the best results are to be obtained.

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[2] For instructions for making Bordeaux mixture, see Circular 48 of the New Jersey Agricultural Experiment Station.

The author's spraying experiments gave a profit of $324 per acre after all costs had been deducted (cover cut).

During the past few years a great many celery growers have hesitated to spray celery with copper sprays on account of the possibilities of copper poisoning to the consumer. No grower need labor under such fear if he will spray his crop with a pressure of 100 pounds or more. Where possible most of the dry spray mixture should be washed off before the crop is sent to market.

List of Circulars on Plant Diseases

The following circulars on plant diseases have been published by the New Jersey Agricultural Experiment Station, and may be obtained free on request while available.

Circular 48. Bordeaux Mixture.
Circular 55. Common Diseases of the Grape.
Circular 68. Common Diseases of Cucumbers and Melons.
Circular 80. Common Diseases of Apples, Pears and Quinces.
Circular 81. Common Diseases of Peach, Plum and Cherry.
Circular 84. Common Diseases of Beans and Peas.
Circular 88. Common Diseases of Berries.
Circular 89. Common Diseases of Garden Vegetables and Truck Crops.
Circular 97. Common Diseases of Ornamental Trees.
Circular 98. Common Diseases of Shade and Ornamental Trees.
Circular 102. Diseases of Grains and Forage Crops.
Circular 104. Diseases of Tomatoes.
Circular 105. Potato Diseases in New Jersey.
Circular 106. Seed and Soil Treatment for Vegetable Diseases.